

**APPLICATION**

5

**FOR UNITED STATES LETTERS PATENT**

10

----

**SPECIFICATION**

15

TO ALL WHOM IT MAY CONCERN:

20

BE IT KNOWN THAT we, **Glen M. Harris**, a citizen of New Zealand, and **Justin M. Henry**, a citizen of Canada, have invented a new and useful passive media content access system of which the following is a specification:

## **Passive Media Content Access System**

5

### **BACKGROUND OF THE INVENTION**

#### **10 Cross-Reference to Related U.S. Provisional Patent Applications**

I hereby claim benefit under Title 35, United States Code, Section 119(e) of United States provisional patent application Serial Number 60/189,487 filed March 15, 2000. This application is a continuation of the 60/189,487 application. The 60/189,487 application is currently pending. The 60/189,487 application is hereby incorporated by reference into this patent application.

#### **Field of the Invention**

The present invention relates generally to remote control devices and more specifically it relates to a passive media content access system for passively monitoring a user's interaction with media content for providing automatic and intuitive control for a home entertainment system.

Television provides an increasing variety of programming to individuals through commercials, infomercials, movies, sitcoms, mini-series and other television broadcasts. Individuals watching a television broadcast often times desire to receive additional information and/or promotional materials relating to a specific broadcast

they are watching. Individuals who watch a specific program such as FRIENDS on NBC often times like to be warned in advance of the show to avoid missing an episode.

5 Individuals also have “habits” when utilizing a home entertainment system. For example, an individual listening to rock music may turn the volume to a higher level during play than when they are listening to contemporary or classical music. The user has to manually adjust the volume of the stereo receiver every time.

10 Hence, there is a need for a remote control system that passively monitors a user’s interaction with media content for providing automatic and intuitive control for a home entertainment system.

### 15 **Description of the Prior Art**

20 Television program has been a valuable advertising and promotional tool for businesses and other entities since the creation of the television. Television provides an effective medium for businesses and groups to convey their message to consumers. Typical television programming consists of commercials, infomercials, documentaries, biographies, movies, sitcoms, mini-series and other items.

25 The main problem with conventional television programming is that it does not allow for an individual to receive additional information regarding a particular television item that the individual is currently watching. Another problem with conventional television programming is that television advertisers lose valuable customers because of the delay of time after an advertisement until the consumer is able to access a computer or telephone resulting in the consumer forgetting about the commercial or losing interest in the subject matter. A further problem with conventional television programming is that there is no effective means for specifically

locating and directing desired information to television watchers that are potentially interested in a particular television program (i.e. "target market").

Conventional remote control units are typically comprised of a housing structure  
5 with a plurality of buttons within a keypad. Conventional remote control units are typically capable of only allowing "manual" control of a home entertainment system such as the television and other external electronic devices. The main problem with conventional remote control units is that they are unable to "intuitively" respond to the user's needs and require the user to direct the remote control to perform basic  
10 operations. Another problem is that individuals who are interested in specific programming on television or radio are often times unable to receive additional information regarding the programming as desired.

While these devices may be suitable for the particular purpose to which they  
15 address, they are not as suitable for passively monitoring a user's interaction with media content for providing automatic and intuitive control for a home entertainment system. Conventional remote controls and media programming simply does not allow for intuitive control over electronic devices within a home entertainment system and other electronic devices. Conventional television programming simply does not allow  
20 for consumers to effectively receive additional information regarding television programming.

In these respects, the passive media content access system according to the present invention substantially departs from the conventional concepts and designs of  
25 the prior art, and in so doing provides an apparatus primarily developed for the purpose of passively monitoring a user's interaction with media content for providing automatic and intuitive control for a home entertainment system.

## SUMMARY OF THE INVENTION

In view of the foregoing disadvantages inherent in the known types of remote control devices and television programming now present in the prior art, the present invention provides a new passive media content access system construction wherein the same can be utilized for allowing a user to mark one or more television programs for passively monitoring a user's interaction with media content for providing automatic and intuitive control for a home entertainment system.

The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new passive media content access system that has many of the advantages of the remote control devices mentioned heretofore and many novel features that result in a new passive media content access system which is not anticipated, rendered obvious, suggested, or even implied by any of the prior art remote control devices, either alone or in any combination thereof.

To attain this, the present invention generally comprises a remote control having an electronic system that monitors the date, time, media type (e.g. cable vs. satellite vs. antenna), current channel that a user is currently viewing and other interactions with electronic devices. Whenever a setting change occurs within the home entertainment system, the electronic system immediately logs the date, time, current channel, and other relevant information for later uploading to a control station. During and after utilizing their home entertainment system, the user may then connect the electronic system to the Internet and upload the automatically logged information to the control station which compares the logged information with previously known programming information to allow for determination of the programming the user was watching or listening to. The control station determines what available information to the send to the user such as e-mail, websites, printed materials, software offers and other

information related to the programming the user is potentially interested in.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter and that will form the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

A primary object of the present invention is to provide a passive media content access system that will overcome the shortcomings of the prior art devices.

A second object is to provide a passive media content access system for passively monitoring a user's interaction with media content for providing automatic and intuitive control for a home entertainment system.

Another object is to provide a passive media content access system that provides an effective method for advertisers to communicate with consumers potentially interested in their products and services.

An additional object is to provide a passive media content access system that provides an effective method for television stations to communicate with consumers interested in their television programming regarding specific programming.

5       A further object is to provide a passive media content access system that allows businesses to forward additional information to consumers via e-mail, web sites, and mailings regarding subject matter a consumer has specifically shown interest in.

10       Another object is to provide a passive media content access system that allows businesses to efficiently market their products and services to a group of consumers having an interest in their products or services without wasting valuable resources promoting items to non-interested consumers.

15       A further object is to provide a passive media content access system that does not require any changes to existing broadcast infrastructure thereby requiring no changes to the media content for operation thereof.

20       Another object is to provide a passive media content access system that will work with existing electronic devices within a room without changes to the devices.

      An additional object is to provide a passive media content access system that automatically records a user's interaction with media content.

25       Another object is to provide a passive media content access system that allows for automatic data collection by advertisers and other businesses.

      A further object is to provide a passive media content access system that intuitively and automatically sets alarms to notify a user of favorite media programming.

Another object is to provide a passive media content access system that works in conjunction with various types of media including but not limited to television and radio.

5

A further object is to provide a passive media content access system that intuitively and automatically takes appropriate action to ensure that a user is able to view and/or listen to their favorite programming.

10

Other objects and advantages of the present invention will become obvious to the reader and it is intended that these objects and advantages are within the scope of the present invention.

15

To the accomplishment of the above and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated and described within the scope of the appended claims.



## BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention  
5 will become fully appreciated as the same becomes better understood when considered  
in conjunction with the accompanying drawings, in which like reference characters  
designate the same or similar parts throughout the several views, and wherein:

FIG. 1 is an upper perspective view of the present invention.

FIG. 2 is a side view of the present invention.

FIG. 3 is a side view of the present invention illustrating electronic circuitry  
within.

FIG. 4 is a block diagram illustrating the communications between the present  
invention and a plurality of external electronic devices.

FIG. 5 is a block diagram illustrating the electronic system of the present  
invention electrically connected to the power source and in communication with the  
external electronic devices.

FIG. 6 is a block diagram illustrating the electronic system along with a  
plurality of accessory devices connected to thereof.

FIG. 7 is a block diagram of the present invention in communication with the  
control station via a global computer network wherein the electronic system is directly  
connected to an intermediary computer system.

FIG. 8 is a block diagram of the present invention in communication with the control station directly via a global computer network without utilizing an intermediary computer system.

5        FIG. 9 is a flowchart illustrating the automatic operation of the electronic system in logging information relating to changes in the device settings.

FIG. 10 is a flowchart illustrating the uploading of logged data contained within the remote control.

10

FIG. 11 is a flowchart illustrating the receiving and utilization of log data from the remote control to determine whether or not to send information to the user.

15        FIG. 12 is a flowchart illustrating the determination of the information desired by the user and the form of its availability.

FIG. 13 is a flowchart illustrating the logging of a favorite show based upon the number of times viewed with a specified period of time and setting an alarm for the next programming event.

20

FIG. 14 is a flowchart illustrating the intuitive and automatic functionality of the present invention regarding a favorite program.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

5 The following description is presented to enable any person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention. Thus, the present invention is not intended to be limited to the  
10 embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

15 The data structures and code described in this detailed description are typically stored on a computer readable storage medium, which may be any device or medium that can store code and/or data for use by a computer system. This includes, but is not limited to, magnetic and optical storage devices such as disk drives, magnetic tape, CDs (compact discs) and DVDs (digital video discs), and computer instruction signals embodied in a transmission medium (with or without a carrier wave upon which the signals are modulated). For example, the transmission medium may include a communications  
20 network, such as but not limited to the Internet or wireless communications.

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, FIGS. 1 through 14 illustrate a passive media content access system **10**, which comprises a remote control having an  
25 electronic system **100** that monitors the date, time, current channel and additional relevant information regarding a media program that a user is currently viewing and/or listening to. The electronic system **110** automatically logs the date, time, current channel and additional relevant information for later uploading to a control station **40**. When the user is finished viewing and/or listening to the media program, they then

connect the electronic system **100** to the Internet **130** and upload the logged information to the control station **40** which matches the logged information with previously known programming information to allow for determination of the programming the user was watching and/or listening to. The control station **40** determines what available information to the send to the user such as e-mail, websites, printed materials, software offers and other information related to the programming the user is interested in.

#### **A. Remote Control Structure**

The present invention generally is comprised of a housing **20** having a structure and shape similar to conventional remote control devices. The housing **20** may be constructed of various types of materials and shapes as can be appreciated by one skilled in the art. The housing is preferably structured to be ergonomic for a majority of users.

The present invention may be utilized to control and operate various external electronic devices including but not limited to televisions, stereos, receivers, VCRs, DVD players, CD players, amplifiers, equalizers, tape players, cable units, satellite dish receivers, lighting, window shades and other electronic devices. Almost any number of external electronic devices may be controlled by the present invention as can be accomplished with conventional remote control devices.

Figure 6 is a block diagram of an exemplary electronic system **100** for practicing the various aspects of the present invention. The electronic system **100** is preferably enclosed within the housing. A portable power source **140** is electrically connected to the electronic system **100** for providing electrical power to the electronic system **100**. The power source **140** may be comprised of any power source such as a battery structure (disposable or rechargeable), solar cells, or direct power.

The electronic system **100** preferably includes a display screen **104**, a network interface **112**, a keypad **114**, a microprocessor **116**, a memory bus **118**, random access memory (RAM) **120**, a speaker **102**, read only memory (ROM) **122**, a peripheral bus **124**, a keypad controller **126**, and a communications device **108**. As can be appreciated, the electronic system **100** of the present invention may be comprised of any combination of well-known computer devices, personal digital assistants (PDAs), laptop computers, remote control devices and other electronic systems.

The microprocessor **116** is a general-purpose digital processor that controls the operation of the electronic system **100**. Microprocessor **116** can be a single-chip processor or implemented with multiple components. Using instructions retrieved from memory, microprocessor **116** controls the reception and manipulations of input data and the output and display of data on output devices.

The memory bus **118** is utilized by microprocessor **116** to access RAM **120** and ROM **122**. RAM **120** is used by microprocessor **116** as a general storage area and as scratch-pad memory, and can also be used to store input data and processed data. ROM **122** can be used to store instructions or program code followed by microprocessor **116** as well as other data.

Peripheral bus **124** is used to access the input, output and storage devices used by the electronic system **100**. In the described embodiment(s), these devices include a display screen **104**, an accessory device **106**, a speaker **102**, a communications device **108**, and a network interface **112**. A keypad controller **126** is used to receive input from the keypad **114** and send decoded symbols for each pressed key to microprocessor **116** over bus **128**.

The display screen **104** is an output device that displays images of data provided by the microprocessor **116** via the peripheral bus **124** or provided by other components

in the electronic system **100**. Other output devices such as a printer, plotter, typesetter, etc. can be utilized as an accessory device **106**.

The microprocessor **116** together with an operating system operate to execute computer code and produce and use data. The computer code and data may reside on RAM **120**, ROM **122**, or other storage mediums. The computer code and data could also reside on a removable program medium and loaded or installed onto the electronic system **100** when needed. Removable program mediums include, for example, PC-CARD, flash memory, and floppy disk.

The network interface **112** is utilized to send and receive data over a network connected to other electronic systems. The network interface may also be comprised of a Universal Serial Bus (USB), an external bus standard that supports data transfer rates of 12 Mbps (12 million bits per second). A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards. An interface card or similar device and appropriate software implemented by microprocessor **116** can be utilized to connect the electronic system **100** to an existing network and transfer data according to standard protocols including data over a global computer network such as the Internet. The electronic system **100** may connect to the Internet **130** via a computer system **60** or directly as illustrated in Figures 7 and 8 respectively.

The keypad **114** is used by a user to input commands and other instructions to the electronic system **100**. Other types of user input devices can also be used in conjunction with the present invention. For example, pointing devices such as a computer mouse, a jog switch **22**, a track ball, a stylus, or a tablet to manipulate a pointer on a screen of the electronic system **100**.

The present invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that

can store data which can be thereafter be read by a electronic system. Examples of the computer readable medium include read-only memory, random-access memory, magnetic data storage devices such as diskettes, and optical data storage devices such as CD-ROMs. The computer readable medium can also be distributed over a network coupled electronic systems so that the computer readable code is stored and executed in a distributed fashion.

The communications device **108** may be comprised of any well-known communication system that allows communications with external electronic devices. The communications device **108** may provide for various types of communication such as but not limited to via infrared (IR), wireless (i.e. BLUETOOTH), unidirectional, bi-directional, radio frequency (RF), visible light, ultrasonic and various other means for communicating with external electronic devices.

Input into the electronic system is accomplished mainly through the usage of the keypad **114**. The keypad **114** includes a plurality of buttons that allow the user to execute one or more commands. The keypad **114** allows for the control of basic functions such as but not limited to volume, channel manipulation, mute, and last channel. Various other input devices may be utilized to input data into the electronic system **100** such as a jog switch **22** (i.e. dial), motion and orientation detectors, touch sensitive screens and voice recognition. The display **104** provides information to the user such as possible tasks to complete or the current state of the external electronic devices.

The electronic system must be capable of storing and logging various types of “event data” such as date, time, current channel and other types of information relevant to determining the identity of a specific media programming at a particular time. The remote control may be comprised of various other well-known structures and functions known in the art. It can also be appreciated that the present invention as disclosed does not require the functionality to control a television or other electronic devices.

## B. Communication System

The present invention is best operated upon a global computer network such as the Internet **130**. A plurality of computer systems around the world are in communication with one another via this global computer network.

The present invention preferably utilizes the Internet **130** for communications, however it can be appreciated that as future technologies are created that various aspects of the invention may be practiced with these improved technologies. In addition, wireless technologies provide a suitable communications medium for operating the present invention.

## C. Web Page

The present invention is preferably utilized in conjunction with information presented upon a web page or other displayable medium representing the control station **40**. A web page is typically comprised of a web page code that is stored upon a computer server. A typical web page includes textual, graphical and audio data within for display upon a computer system **60** and may be comprised of various formats.

The web page code may be formatted such as but not limited to HTML (Hyper-Text Markup Language), XML (Extensible Markup Language), HDML (Handheld Device Markup Language), and WML (Wireless Markup Language) that is displayable upon a computer system. Scripts such as JavaScript may be included within the web page code to request the server computer to request a specific audio file to be played with respect to an advertisement. As can be appreciated, additional formats for the web page code may be utilized as developed.

The web page code is retrieved by a computer system **60** or electronic system **100** via the Internet, wireless network or other communications channel utilizing a



conventional web browser such as but not limited to NETSCAPE or MICROSOFT INTERNET EXPLORER. An individual using the consumer computer system 60 enters the URL (Uniform Resource Locator) or the electronic system 100 enters the URL identifying the web page to retrieve the web page code associated with the desired web page.

#### **D. Automatic Logging**

Whenever a change occurs within a device (e.g. television turned on/off; radio volume increased, etc.), the electronic system 100 automatically “logs” the “event data” (i.e. date, time, current channel, device information, etc.). It can be appreciated that the user may have the option of inputting additional data to correspond with the event data such as limiting the type of information they desire to receive relating to a television program they watch or limiting information only to sport related media programming. The user may also control the type of data automatically logged.

#### **E. Event Data**

“Event data” such as date, time, current channel, settings, device information, and other types of information is utilized by the control station 40 to identify the specific media programming at a particular time. Event data may also include additional information such as the user’s preferences regarding the information they receive.

For example, the user could program into the electronic system 100 that they desire to only receive e-mail and web site information regarding television events they have watched at least three times in one month. Various other types of information may be input by the user and recorded by the electronic system 100 that are relevant to media event information and user preferences as can be appreciated.

## F. Control Station

The control station **40** is in communication with the Internet **130** via various well-known means. The control station **40** is preferably accessed by users via a web page which allows the users to identify themselves and modify user settings. The user may input various conditions and requirements regarding the additional information they receive via this web page which may also be accomplished by inputting additional data into the electronic system **100**.

The user may control via the control station **40** the amount of information they receive (e.g. no more than 5 e-mails per day), the type of information they receive (e.g. only e-mails), when and where they receive the information (e.g. after 5 p.m. only for e-mails directed to their home e-mail address) and other control settings that are desirable by a user. The user control settings may be modified at any time via the web page or other means.

The control station **40** is in communication with one or more programming stations **50** that provide updated media programming information to the control station **40**. The programming stations **50** may be comprised of broadcasters, advertisers or other entities able to provide the necessary programming information. The media programming information is basically comprised of date, time, channel, settings, title and other related information. It can be appreciated that additional types of event information may be received and stored by the control station **40**.

In addition to the television event information, the control station **40** maintains “available information” data relating to each of the media programming. The available information data is basically comprised of a listing of information available to provide to the user if they are interested in receiving additional information about a specific television event. The media event information and the available information may be maintained in a single or separate databases as can be appreciated. In addition, the media event

information and the available information are periodically updated to ensure the accuracy of the information in case of changes in media programming and available information.

The control station 40 is able to also create and update a database of the user's media related patterns such as the type of programming they view and/or listen to, what time of day they view and/or listen to media, what type of media do they view and/or listen to and other important information relating to consumers viewing media. The control station 40 is therefore able to "predict" the user's future behavior based upon the advance knowledge of the type of media programming to be aired in the future. The control station 40 may providing coding to the electronic system 100 regarding how to intuitively operate around the user. As more time passes and a greater sampling of data is collected regarding the user's media patterns, the more accurate the control station 40 is able to be in determining the likes and dislikes of user.

#### **G. Information Provided to User**

It can be appreciated that a virtually unlimited amount of information may be provided to a user regarding various media programming that they consistently view and/or listen to. Information such as e-mails, web site information, printed materials, and sample products may be provided to the user relating to the programming they are potentially interested in.

Additional information may be provided to the user such as product samples, product offers and discounts, software, promotional items, screensavers, and the like. The information provided to the user may be sent immediately after the control station 40 determines the media programming the user is interested in or over a period of time wherein the user is basically maintained on a "mailing list" to receive additional information in the future.

## H. Intuitive Functionality

The automatic logging of device changes provides in effect a database within the electronic system **100** that may be analyzed to determine patterns that may characterize a specific behavioral pattern within the user along with their respective likes and dislikes. Whenever the user views a television program, the electronic system **100** is able to log the date, time, channel and other information relating to the viewing of the television program. In addition, the electronic system **100** is able to determine when the user terminated viewing the television program along with the total amount of time spent viewing the program.

The combination of various data types allow the electronic system **100** and/or control station **40** “predict” what the user would like to have accomplished by the home entertainment system in specific circumstances. As illustrated in Figure 13 of the drawings, the electronic system **100** monitors whether a setting change occurs within an external electronic device **12** and then determines whether the setting change falls into a previously determined pattern. If so, then the “pattern” is logged into the electronic system **100** to assist in the intuitive operation of the present invention.

For example, if the user turns on the television and views channel 10 every Thursday at 7:00pm with the stereo turned on and the audio input switched to the television, the electronic system **100** is able to determine over a period of similar events that the user desires to watch the television program that occurs on channel 10 on Thursday at 7:00pm. Not only is the electronic system **100** capable of automatically setting an alarm to notify the user of this favorite event, but the electronic system **100** is able to turn a VCR on if it is determined that the user is not watching the favorite program as is shown in Figure 14 of the drawings. The electronic system **100** also has the ability to produce an audible alarm when the favorite programming is about to be on or is on to alert the user to turn the television on.

The control station **40** provides an added level of functionality to the electronic system **100** in that the control station **40** is able to determine the “type” of media programming that the user is interested in. For example, the control station **40** is able to determine whether the user watches comedies more than dramas and can alert the user to programming similar to their likes and avoid alerting the user to programming that they potentially will dislike. Various other functionality is readily apparent for the present invention which will not be discussed further.

## **I. Operation**

In use, the user first ensures that the electronic system **100** has the correct date and time information. If the date and/or time are incorrect, the user reprograms the electronic system **100** via the keypad **114** to contain the correct date and time or the date/time may be automatically updated when connected to the control station **40**. The user would also input the current channel the television and/or radio station are set to allow for synchronization of the electronic system **100** with the television and stereo. The user then utilizes the remote control to switch the current channel either by directly entering the channel number or by selecting a “channel up” or “channel down” button that are common with conventional remote controls for controlling a television, cable box, television, VCR, stereo and other electronic devices controlling the media the user is viewing and listening to. The electronic system **100** constantly monitors and logs the “current channel” by compensating for selections of the channel up or channel down buttons on the keypad **114** to allow for “mirroring” the settings (e.g. power on/off, channel, volume level, video/audio input, etc.) of the television as is illustrated in Figure 9 of the drawings. After the user is finished watching television, listening to the stereo and other media, they may then upload the logged event data to the control station **40** as shown in Figures 7, 8, 10 and 11 of the drawings. The uploading of the logged event data may be in real-time and continuous. After uploading the event date, the event data is preferably cleared from the electronic system **100** to prevent duplication of information sent to the user. When the control station **40** receives the

uploaded event data, the control station 40 compares the event data to the programming schedules received from the programming stations 50 to determine the actual television, radio or other event the user is potentially interested in receiving additional information about. If no information is available, the user is informed that "No Information is Available" for a specific television event. If information is available to send to the user, then depending upon the type of information available and the preferences preset by the user, various types of information may be sent to the user relating to the television event(s) they are interested in as is shown in Figures 11 and 12 of the drawings. In addition, the control station 40 may program the electronic system 100 to recognize future media events and to alert the user to these events that may be related to programming that the user has shown considerable interest in through their interaction with media content. There is no requirement for interaction between the user and the electronic system regarding the logging of events. The logged information may also be aggregated in a statistic format for use by third-parties.

As to a further discussion of the manner of usage and operation of the present invention, the same should be apparent from the above description. Accordingly, no further discussion relating to the manner of usage and operation will be provided.

With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed to be within the expertise of those skilled in the art, and all equivalent structural variations and relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction

and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.